

REMARKS

This responds to the Office Action mailed on January 7, 2004.

Claims 1, 7, 8, 12, 14, 16 and 22 are amended. Claims 1-22 are pending in this application.

Claim Objections

Claim 12 was objected to due to informalities. Claim 12 has been amended to correct a typographical error by changing the dependency from claim 11 to claim 10. The Examiner is respectfully requested to reconsider the objection to claim 12.

§103 Rejection of the Claims

Claims 1, 2, 4-6, 8, 9, 11-13, 16, 17 and 19-21 were rejected under 35 USC § 103(a) as being unpatentable over Thacker (U.S. 5,313,501) in view of Collins et al. (U.S. 6,031,847).

Claims 1, 8 and 16 have been amended to more clearly define the present invention without the addition of new matter.

The claims have been amended to include the feature that, once de-skewed, the control state machine refrains from further control of the signals unless deemed necessary by the respective receiver. The receiver can modify the state of the de-skew enable input signal to re-initiate the de-skew process (see page 12 of the specification).

The de-skewing technique in accordance with the present invention significantly reduces the implementation requirements of a multi-lane receiver by removing the overhead of de-skewing the link from the receiver. A de-skewing arrangement in accordance with the present invention responds to a single control signal from the receiver block and provides a single status output indicating the current de-skew status, that is, valid or invalid. The lane circuitry can be replicated/configured to support any width link without modifications to the control state machine. The corresponding lane circuitry can be easily modified to support any specified tolerance simply by adding or removing the data buffering logic and the tolerance counter terminal value. The arrangement operates completely independently of the elastic buffer and places no additional requirements on its functionality. The pipelined architecture allows the circuit to have no latency impact on performance.

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Neither Thacker (U.S. 5,313,501) nor Collins et al. (U.S. 6,031,847) teach a training of the system for de-skewing which occurs on an as needed basis. According to the present application, a link training sequence is an ordered predetermined set of data used to calibrate the de-skewing unit 435 so that subsequent data input will be properly aligned. A typical link training sequence may, for example, include a sixteen symbol ordered-set comprised of a comma character, a lane identifier, and fourteen data symbols which are unique to this training sequence. Furthermore, it is necessary to determine the maximum amount of skew which will be corrected between all of the lanes in the multi-lane link. This skew defines the maximum allowable difference or tolerance, specified in clock cycles, between the corresponding lanes from the transmitter to the receiver. For example, if each lane was transmitting the link training sequence, the tolerance would define the maximum number of clocks from the reception of the first comma character in any lane until all of the associated comma characters have been received on all of the lanes. Note that the use of a comma character in training the de-skewing unit 435 is merely for exemplary purposes in the following description and any character or symbol may in fact be used for training purposes.

The enable and clear outputs of the control state machine are connected to each lane's tolerance counters in parallel. Once de-skewed, the control state machine 610 refrains from further control of these signals unless deemed necessary by the respective receiver. The receiver can modify the state of the de-skew enable input signal to re-initiate the de-skew process.

Thus, the claims as amended distinguish over the cited prior art and the Examiner is respectfully requested to reconsider the rejections of these claims.

Claims 3, 10, 15 and 18 were also rejected under 35 USC § 103(a) as being unpatentable over Thacker in view of Collins et al., and further in view of Brown et al. (U.S. 6,553,505).

For the reasons set forth above the claims as amended distinguish over the cited prior art and the Examiner is respectfully requested to reconsider the rejections of these claims.

Allowable Subject Matter

Claims 7, 14 and 22 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111

Serial Number: 09/660909

Filing Date: September 13, 2000

Title: MULTI-LANE RECEIVER DE-SKEWING

Assignee: Intel Corporation

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Dkt: 884.958US1 (INTEL)

Claims 7, 14 and 22 have been amended to place them into independent form including all of the limitations of the respective base claim and any intervening claims. The Examiner therefore respectfully requested to reconsider the objection to these claims.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney, John Garrett at (847) 740-9080, or Applicant's below-named representative at (612) 349-9592 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

DEAN S. SUSNOW ET AL.

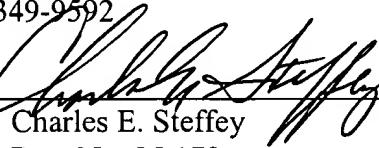
By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
Attorneys for Intel Corporation
P.O. Box 2938
Minneapolis, Minnesota 55402
(612) 349-9592

Date

April 7, 2004

By


Charles E. Steffey
Reg. No. 25,179

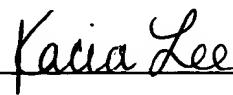
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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 7 day of April, 2004.

Name

KACIA LEE

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Kacia Lee


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